

Observations on the Biology of *Gymnaetron pascuorum* (Gyll.) (Coleoptera: Curculionidae)¹

E. A. DICKASON

OREGON STATE UNIVERSITY, CORVALLIS

Gymnaetron pascuorum (Gyllenhal) is a European species believed to have been introduced into eastern United States sometime prior to 1952 (Sleeper, 1954). At that time it was collected from strawberry, potato, and alfalfa plants. Warner (1964) gave the first Oregon record as 1960 when adults were found on the bark of Colorado blue spruce, *Picea pungens*, stated that the species had been reported from eastern United States as breeding in buckhorn plantain, *Plantago lanceolata* L., and added that adults had been collected from the tunnels of the dogwood borer, *Thamnospectia scitula*, and found in association with mantid eggs, *Tenodera* sp. Adults were reared from the spikes of buckhorn plantain in western Oregon during July, 1963, and identified by R. E. Warner, U. S. National Museum.

There are several European references listing *P. lanceolata* as the host plant, but only brief comments were found relating to the biology of the weevil. Bargagli (1885) stated the larvae are in the seeds of *P. lanceolata* and that the insect completed its development in the month of August. Hoffman (1958) stated that the larvae do not form galls, and that eggs are laid in May to July and that the adults emerge in August and September.

The general features of the biology of *G. pascuorum* were investigated in western Oregon because most aspects of the life history were unknown. The host plant, *P. lanceolata*, is probably a plant native to Europe that has spread rapidly during the past 50 years in the northwestern United States and is a known causative agent of hay fever (Gilkey, 1957). It is a competitive weed in pastures and cultivated crops and a restricted noxious weed in vegetable and field crop seeds (Warren, 1957).

METHODS

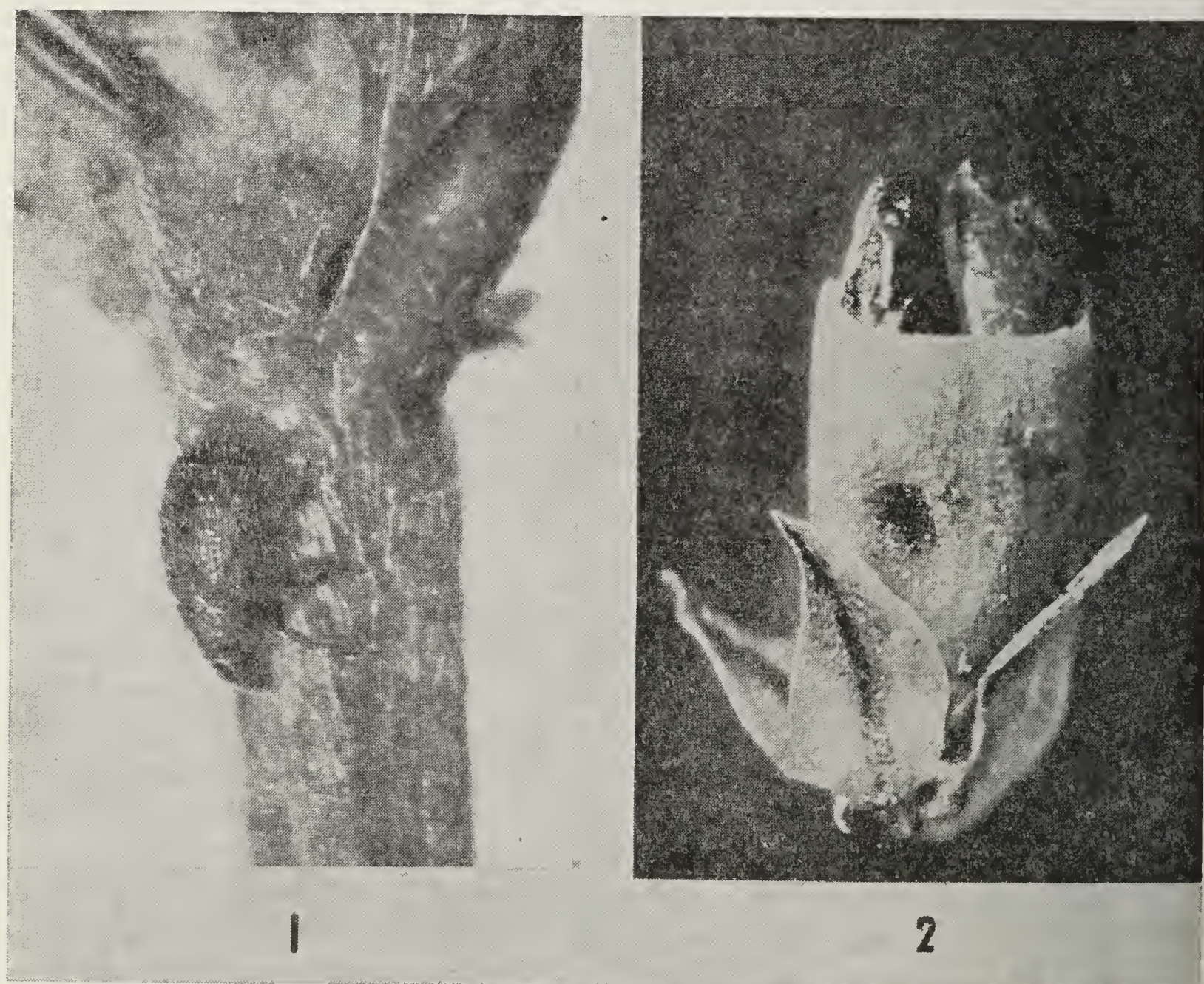
Field-collected buckhorn plantain was held for insect rearing studies under laboratory conditions by confining either individual plant material spikes or detached florets in cotton-stoppered shell vials or in petri dishes. Individual spikes of insectary-grown plants were caged, and permitted to continue growth in plastic petri dishes modified as follows: One lip of the top and bottom of the dish was cut to accommodate a cotton-wrapped plantain scape and thus form an "insect proof" seal for the spike. Four ¼ inch holes were drilled in both the top and bottom of the petri dish for ventilation, and the holes closed with a fine-mesh screening. The cages were held in position on plant stakes by elastic bands. This procedure permitted the admission of mated pairs of weevils at the appropriate stage of plant development. Population trends of adults were estimated by sweeping weedy areas with an insect net.

¹Technical paper no. 2291, Oregon Agricultural Experiment Station, Corvallis.

RESULTS AND DISCUSSION

Adults left their overwintering sites and appeared on buckhorn plantain at the time the earliest spikes developed and the basal florets bloomed. This varied from the 3rd to 4th week in May in western Oregon. The adults fed in the portion of the scape 1 to 5 mm. below the base of the spike (Fig. 1). They clasped the angulated scape along the ribbed area and inserted their beak deeply into the furrowed area and remained outwardly immobile. Possibly this feeding was essential to sexual maturity as mating pairs were then observed for approximately six weeks, or until late June.

Examination of field-collected plant materials indicated that oviposition takes place during June and into mid-July. Apparently there was an extended oviposition period because during mid-July eggs, larvae, pupae, and teneral adults were dissected from spikes. Because of the difficulty involved in observing weevil activity in the compact spike, oviposition was not observed. Adults commonly wedged themselves between the florets, with the head directed inward, and were never observed to assume an attitude on the spike that suggested oviposition.



FIGURES 1-2, 1—*Gymnaetron pascuorum* feeding on scape of plantain (adult length, 1.8-2.0 mm). 2—Capsule of *Plantago lanceolata* showing oviposition site (center of capsule), initially infested and darkened seed (upper left), and subsequent larval injured, but normal colored, seed (upper right).

Possibly the oviposition cavity was formed with the beak because there was a small entry hole (approximately 0.1 mm. in diameter) in the side of the circumscissile capsule (Fig. 2), and a definite chamber or cell (approximately 0.2 mm. in diameter by 0.3–0.35 mm. long) in the developing seed. The elongate egg was free in the chamber, except the posterior end was firmly attached to the wall of the entry hole.

There was a plant reaction to the insect's activities. The tissue surrounding the entry hole on the capsule darkened in color (Fig. 2), and the developing seed darkened in contrast to the light brown color of the paired seed (Fig. 2). This response was more striking early in the oviposition period than later, and may be a reflection of plant maturity. Since oviposition was not observed, dissection of plantain seeds for observations on the duration of the egg stage were necessarily based on ova of unknown age classes. Thus, the duration in days from collection to dissection (which resulted in desiccation of the egg and terminated the observation) ranged from 3 to 11 days for hatching.

The newly hatched larvae were completely protected within the developing seed. They fed initially by extending the egg gallery and, as they developed, they consumed the greater part of the initially attacked seed. Then, they penetrated the septum separating the paired seeds and fed to a varying extent on the paired seed and often the wall of the capsule. The previously mentioned plant reaction or darkening of tissue color was not as evident from larval feeding as it was from oviposition injury. Occasionally, the second seed attacked darkened slightly adjacent to the feeding injury, but most often it remained a much lighter brown in color than the earlier attacked seed (Fig. 2, upper right seed). Injured seeds were not viable, although uninjured seeds had only 64 percent germination when incubated 3 weeks.

The duration of the various larval stages was not determined because any attempt to dissect the early larvae from the seeds resulted in death of the individuals exposed. Last instar larvae, which had consumed enough of the seed to be exposed, pupated in the laboratory. Teneral adults emerged within 5 to 8 days and became fully colored in an additional 48 hours. Depending on the season, newly emerged adults were collected in the field from the first or second week in July until the third week in August. The adults gradually disappeared from the field during late August and early September, although buckhorn plantain spikes were still available in all stages of development. There was a seemingly long period of time in which all stages of insect development were present in the field. It was concluded that there was not a second generation but more probably a sequence of brood development correlated with the phenological sequence of the host.

The sweep-net sampling gave only approximate trends in weevil populations. Based on 10 sweeps per sampling site, and from 3 to 10 sampling sites per field trip, the following general trends were evident: 1) No weevils were recovered prior to late May. 2) First recoveries averaged around 1 weevil per 10 sweeps, and during early June (peak recoveries for the season) they averaged a little over 10 per 10 sweeps. 3) Counts dropped rapidly during June, and by early July averaged around 1 per 10 sweeps. 4) From mid-July to mid-August (new brood

emergence) most counts were around 0.5 per 10 sweeps. 5) From the 2nd to 3rd week in August counts rose from slightly over 1 to around 3 per 10 sweeps, and then gradually declined and no weevils were recovered by sweeping after the first week in September.

In an attempt to determine the duration of the life cycle, plantain was grown in an insectary and spikes of the plant were isolated in 12 petri dish cages. One pair of mating weevils was admitted to each cage. Under these conditions, the time from mating (pre-oviposition) to emergence of adults ranged from 40 to 58 days. No mating was observed among the newly emerged adults, which suggested there was no attempt to initiate a second generation; however, being confined on a matured plantain spike rather than a developing spike may have precluded mating and oviposition stimuli.

The maximum yield was 33 weevils per cage, and the minimum was one weevil per cage (average 14.2), excepting the 3 cages in which adults died prior to oviposition. This is a tentative estimate of fecundity because of the numerous biological limitations placed on the insects confined with a single plantain spike.

Parasitism was determined by placing flowers with oviposition scars in individual vials for laboratory rearing. The most common species reared was *Xenocrepis* sp. (Pteromalidae), determined by B. D. Burks, U. S. National Museum. Unfortunately it is not a species that appears in the U. S. N. M. collection; so it is not known if it is an indigenous species or one introduced with the weevil. No reference to parasitism of *G. pascuorum* was found in the literature. A few specimens of *Eupelmella vesicularis* (Retz.) (Eupelmidae) were reared and these were determined by Dr. Burks who commented that this species has a wide host range and is usually a hyper-parasite. The latter species has been reported from various hosts in Oregon and the Pacific Northwest (Peck, 1963).

Xenocrepis adults began emergence around the 3rd week in July and continued to emerge through the first week in August. As a rule, the parasites emerged from 1 to 3 days prior to weevil emergence from plant materials of comparable collecting dates. Considering all of the laboratory rearing trials conducted during three seasons, the extent of parasitism was negligible; however, considering only plantain spikes that produced parasitized weevils, the range of parasitism was from 28 to 100 per cent. Only an occasional (possibly hyperparasite) individual of *E. vesicularis* was reared.

Overwintering weevils were recovered from modified Berlese-type funnel-processed samples of grass crowns, moss, and soil litter from roadsides, abandoned fields, and wooded areas. Only one live adult was recovered from several hundred winter-collected samples of plantain spikes, and none was recovered from the crown, roots, or old plantain debris during winter months. Adequate protection may be the primary requirement for overwintering, and might explain the unusual habitats for this weevil reported by Warner (1964).

The population density of *G. pascuorum* present in western Oregon during the 1963 to 1965 seasons had very little effect on plantain seed production. The spikes produced in late summer and early fall escaped the oviposition period. Spikes

produced early in the season were either not infested or yielded only 1 to 3 adults, which, assuming two seeds were injured by each larva, and an average of 72 mature seeds per spike, would represent a 3 to 9 percent seed reduction in infested spikes. The impact this weevil could exert on plantain stands is further diluted by adaptations of the plant. The seed remains viable when buried in soil for several years, and it is a perennial plant that can reproduce by crown expansion (Gilkey, 1957, Warren, 1957).

LITERATURE CITED

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Current Literature

HELGESEN, R. G. and POST, R. L., 1967. *Saprophagous Scarabaeidae of North Dakota*. North Dakota Insects—Pub. No. 7. Dept. of Entom., Ag. Ex. Sta., North Dakota State Univ., Fargo, N. D., 60 pp., 45 figs.

In this monograph the taxonomy and ecology of 50 species in 5 sub-families and 14 genera are described for North Dakota. Data extending the range of many species are given.

Luis E. Peña, Secretary, Sociedad Chilena de Entomologia, announces the forecoming appearance of No. 6, *Revista Chilena de Entomologia*, March 1968. Total length, 250 pp., consisting of several collected papers.

A new journal, *Oriental Insects*, has been founded to enable entomologists engaged in the study of the insect fauna of south and southeastern Asia to publish their results in one place. The scope of the journal is broad, covering many areas of insect study. It is anticipated to be a quarterly of about 100 pages. Rates to individuals \$7.00 per year, to institutions, \$10.00. Write Dr. V. K. Gupta, Dept. of Zoology, Univ. of Delhi, Delhi-7, India.—N.M.D.